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SECTION 5: RISK ASSESSMENT

According to FEMA Guidance 386-2, “risk assessment is the process of measuring the potential loss of life, personal injury, economic injury and property damage resulting from natural hazards by assessing the vulnerability of people, buildings and infrastructure to natural hazards.” SC’s risk assessment is organized into four sections. Section 5.1 describes the methodology and tools used to support the risk assessment process. Section 5.2 identifies the natural hazards of concern for further profiling and evaluation. In Section 5.3, the identified hazards of concern are ranked for SC as a whole to describe their probability of occurrence and their impact on population, property (general building stock including critical facilities) and the economy. Lastly, Section 5.4 profiles and assesses vulnerability for each hazard of concern.

5.1 METHODOLOGY AND TOOLS

This section describes the methodology and tools used to support the risk assessment process.

Methodology

The risk assessment process used for this Plan is consistent with the process and steps presented in FEMA 386-2, State and Local Mitigation Planning How-to-Guide, Understanding Your Risks – Identifying Hazards and Estimating Losses (FEMA 2001). This process identifies and profiles the hazards of concern and assesses the vulnerability of assets (population, structures, critical facilities and the economy) at risk in the community. A risk assessment provides a foundation for the community's decision makers to evaluate mitigation measures that can help reduce the impacts of a hazard when one occurs (Sections 6 and 9 of this plan).

Step 1: The first step of the risk assessment process is to identify the hazards of concern. FEMA's current regulations only require an evaluation of natural hazards. Natural hazards are natural events that threaten lives, property, and many other assets. Often, natural hazards can be predicted, where they tend to occur repeatedly in the same geographical locations because they are related to weather patterns or physical characteristics of an area.

Step 2: The next step of the risk assessment is to prepare a profile for each hazard of concern. These profiles assist communities in evaluating and comparing the hazards that can impact their area. Each type of hazard has unique characteristics that vary from event to event. That is, the impacts associated with a specific hazard can vary depending on the magnitude and location of each event (a hazard event is a specific, uninterrupted occurrence of a particular type of hazard). Further, the probability of occurrence of a hazard in a given location impacts the priority assigned to that hazard. Finally, each hazard will impact different communities in different ways, based on geography, local development, population distribution, age of buildings, and mitigation measures already implemented.

Steps 3 and 4: To understand risk, a community must evaluate what assets it possesses and which assets are exposed or vulnerable to the identified hazards of concern. Hazard profile information combined with data regarding population, demographics, general building stock, and critical facilities at risk, located in Section 4, prepares the community to develop risk scenarios and estimate potential damages and losses for each hazard.

Tools

To address the requirements of DMA 2000 and better understand potential vulnerability and losses associated with hazards of concern, SC used standardized tools, combined with local, state, and federal data and expertise to conduct the risk assessment. Two standardized tools used to support the risk assessment are introduced below.

Hazard Identification and Risk Assessment (HIRA)

HIRA-NY is an interactive spreadsheet application designed to support communities in evaluating hazards that could be a concern. This tool was developed by NYSEMO to support consistent identification and ranking of hazards across the State. The program leads the user through a series of four steps: (1) Identify the Hazards, (2) Profile Hazard Events, (3) Inventory Assets, and (4) Estimate Losses.

On October 11, 2006, NYSEMO led a demonstration and training session on use of HIRA-NY to the Planning Committee. The planning process for this effort used Step 1 of HIRA-NY to identify and

determine the prevalent hazards of concern pertaining to the County as a whole, and each participating jurisdiction.

Hazards U.S. – Multi-Hazard (HAZUS-MH)

In 1997, FEMA developed a standardized model for estimating losses caused by earthquakes, known as Hazards U.S. or HAZUS. HAZUS was developed in response to the need for more effective national-, state-, and community-level planning and the need to identify areas that face the highest risk and potential for loss. HAZUS was expanded into a multi-hazard methodology, HAZUS-MH with new models for estimating potential losses from wind (hurricanes) and flood (riverine and coastal) hazards. HAZUS-MH is a Geographic Information System (GIS)-based software tool that applies engineering and scientific risk calculations that have been developed by hazard and information technology experts to provide defensible damage and loss estimates. These methodologies are accepted by FEMA and provide a consistent framework for assessing risk across a variety of hazards. The GIS framework also supports the evaluation of hazards and assessment of inventory and loss estimates for these hazards.

HAZUS-MH uses GIS technology to produce detailed maps and analytical reports that estimate a community's direct physical damage to building stock, critical facilities, transportation systems and utility systems. To generate this information, HAZUS-MH uses default HAZUS-MH provided data for inventory, vulnerability, and hazards. There are certain limitations to using HAZUS-MH. This plan utilized HAZUS-MH default general building stock and population data to perform a HAZUS-MH Level 1 analysis. HAZUS-MH is only intended to provide an estimation of building replacement value, using estimates for typical buildings in a given census block. It is only as current and/or accurate as the U.S. Census 2000 data, and it does not reflect specific local building conditions, such as a higher percentage of luxury structures, higher local costs to procure and transport building materials through New York City, and the recent dramatic worldwide increases in the cost of building construction materials and products and/or services dependent upon the price of petroleum. Plan participants have indicated the values presented herein significantly underestimate the actual Replacement Cost Values (RCV) in Suffolk County.

Default critical facility inventory data was supplemented with local data to provide a more refined analysis. HAZUS-MH damage reports can include induced damage (inundation, fire, threats posed by hazardous materials and debris) and direct economic and social losses (casualties, shelter requirements, and economic impact) depending on the hazard and available local data. HAZUS-MH's open data architecture can be used to manage community GIS data in a central location. The use of this software also promotes consistency of data output now and in the future and standardization of data collection and storage. The guidance *Using HAZUS-MH for Risk Assessment: How-to Guide* (FEMA 433) was used to support the application of HAZUS-MH for this risk assessment and plan. More information on HAZUS-MH is available at <http://www.fema.gov/plan/prevent/hazus/index.shtm>.

Two methodologies were used to assess potential exposure and losses associated with hazards of concern for SC. Both approaches used HAZUS-MH to some extent and are summarized below:

- HAZUS-MH was customized and applied using HAZUS-MH software and associated tools to estimate losses associated with the flood and hurricane hazards. For the flood hazard, the damage functions in HAZUS-MH Flood Wizard were replaced with the coastal damage functions from HAZUS-MH MR1 to model the coastal flooding hazard. For hurricanes, currently HAZUS-MH only analyzes the flood and wind models separately, producing independent results. However, it is recognized that hurricanes cause both wind and storm surge related damage. An attempt was made to combine these hazards to produce wind and storm surge loss estimates for the hurricane hazard

using HAZUS-MH. Further detail on this methodology is located in Section 5 in the hurricane profile. In addition, potential losses calculated using the HAZUS-MH hurricane model (wind only) are integrated and presented for other high wind events such as Nor'Easters and severe storms.)

- HAZUS-MH support was used to evaluate other hazards, as feasible. For many of the hazards evaluated in this risk assessment, historic data are not adequate to model future losses at this time. However, HAZUS-MH can map hazard areas and calculate exposures if geographic information on the locations of the hazards and inventory data are available. For some of the other hazards of concern, areas and inventory susceptible to specific hazards were mapped and exposure was evaluated to help guide mitigation efforts discussed in Section 6. For other hazards, a qualitative analysis was conducted using the best available data and professional judgment.

For this risk assessment, the loss estimates, exposure assessments, and hazard-specific vulnerability evaluations rely on the best available data and methodologies. Uncertainties are inherent in any loss estimation methodology and arise in part from incomplete scientific knowledge concerning natural hazards and their affects on the built environment. Uncertainties also result from the following:

- 1) Approximations and simplifications necessary to conduct such a study
- 2) Incomplete or dated inventory, demographic, or economic parameter data
- 3) The unique nature, geographic extent, and severity of each hazard
- 4) Mitigation measures already employed by SC and the amount of advance notice residents have to prepare for a specific hazard event

These factors can result in a range of uncertainty in loss estimates, possibly by a factor of two or more. Therefore, potential exposure and loss estimates are approximate. These results do not predict precise results and should be used to understand relative risk. Over the long term, SC will collect additional data to assist in developing refined estimates of vulnerabilities to natural hazards.

5.2 IDENTIFICATION OF HAZARDS OF CONCERN

To provide a strong foundation for mitigation actions considered in Sections 6 and 9, Suffolk County (SC) focused on considering a full range of hazards that could impact the area, and then identified and ranked those hazards that presented the greatest concern. The hazard of concern identification process incorporated input from the County and participating jurisdictions; review of the New York State (NYS) Basic HMP; research and local, state, and federal information on the frequency, magnitude, and costs associated with the various hazards that have previously, or could feasibly, impact the region; and qualitative or anecdotal information regarding natural hazards and the perceived vulnerability of the study area's assets to them. Table 5-1 documents the process of identifying the natural hazards of concern for further profiling and evaluation.

Hazards of Concern
are those hazards that are considered most likely to impact a community. These are identified using available data and local knowledge.

For the purposes of this planning effort, the Planning Committee chose to group some hazards together, based on the similarity of hazard events, their typical concurrence or their impacts, consideration of how hazards have been grouped in FEMA guidance documents (FEMA 386-2, "Understanding Your Risks, Identifying Hazards and Estimating Losses; FEMA's "Multi-Hazard Identification and Risk Assessment – The Cornerstone of the National Mitigation Strategy"), and consideration of hazard grouping in the NYS Basic HMP.

Tropical cyclones (hurricanes, tropical storms and tropical depressions) shall be grouped under the "Hurricane" hazard. Due to the great amount of post-Katrina media attention on the exposure and risk of Long Island to hurricanes, the planning committee felt that having hurricanes identified separately from extra-tropical storms and other severe storm events was prudent. Extra-tropical cyclones (Nor'Easters and severe winter low-pressure systems) shall be grouped under the "Nor'Easter" hazard.

The "Severe Storm" hazard includes windstorms that often entail a variety of other influencing weather conditions including thunderstorms, hail, and tornados. Tropical and extra-tropical cyclones, sometimes grouped together under a coastal storms hazard (FEMA 386-2), are being grouped in separate hazard categories as explained above.

The "Flooding" hazard includes riverine flooding, flash flooding, urban flooding (local drainage problems), and coastal flooding (including storm surges). Inclusion of the various forms of flooding under a general "Flood" hazard is consistent with that used in FEMA's "Multi-Hazard Identification and Risk Assessment" guidance.

The "Severe Winter Storm" hazard includes heavy snowfall, blizzards, and ice storms. This grouping is consistent with that used in the NYS Basic HMP.

SECTION 5.2: RISK ASSESSMENT – IDENTIFICATION OF HAZARDS OF CONCERN

Table 5-1. Identification of Hazards of Concern for Suffolk County

Hazard	Step 1	Step 2	Step 3	
	Is this a hazard that may occur in SC?	If yes, does this hazard pose a significant threat to the County?	Why was this determination made?	Source(s)
Natural				
Avalanche	No	No	<ul style="list-style-type: none"> The topography and climate of SC does not support the occurrence of an avalanche event. NYS in general has a very low occurrence of avalanche events based on statistics provided by National Avalanche Center – American Avalanche Association (NAC-AAA) between 1950 and 2006. Avalanche was not identified as a hazard in the NYS Plan. 	<ul style="list-style-type: none"> NYS Plan Input from PC Review of NAC-AAA database between 1950 and 2006.
Coastal Erosion	Yes	Yes	<ul style="list-style-type: none"> SC is primarily bounded to the north, south and east by coastal waters. Coastal erosion hazard history, including the following hazards: <ul style="list-style-type: none"> Nor'easter 1931 (created Moriches Inlet) Long Island Express – September 1938 (Created or significantly widened 12 new inlets along the Island – including Shinnecock Inlet and Moriches Inlet, as a result of storm surge) September 1985 Hurricane Gloria (DR-750) Nor'easter 1987 – 1 of top 3 erosion events on Long Island August 1991 Hurricane Bob (DR-918) October 1991 – Perfect Storm – 1 of top 3 erosion events on Long Island (layer of sand 5 ft deep disappeared from Babylon Beaches, Crescent Island (Shelter Island) was completely eroded, Orient Beach (Southold was the hardest hit) Nor'easter 1992 (DR-974) (Gilgo Beach in Babylon destroyed after just being backfilled with thousands of tons of sand from USACE) October 2005 Tropical Storm Ernesto, September 2006 Millions in damages have resulted from road, homes, barrier beaches, piers/docks being destroyed or damaged as a result of coastal erosion. The PC identified coastal erosion as a significant concern affecting the County. Several jurisdictions along the north shore identified areas of coastal bluff erosion. As these impacts appear be directly related to coastal erosive forces, they will be considered under the "Coastal Erosion) hazard. 	<ul style="list-style-type: none"> NYS Plan Input from PC FEMA NWS USEPA NOAA-NCDC Newsday.com
Coastal Storm (tropical and extra-tropical cyclones)	Yes	Yes	For tropical cyclones, please see "Hurricane/Tropical Storms. For extra-tropical cyclones, please see "Nor'Easters"	

SECTION 5.2: RISK ASSESSMENT – IDENTIFICATION OF HAZARDS OF CONCERN

Hazard	Step 1	Step 2	Step 3	
	Is this a hazard that may occur in SC?	If yes, does this hazard pose a significant threat to the County?	Why was this determination made?	Source(s)
Drought	Yes	Yes	<ul style="list-style-type: none"> Many statewide drought events, resulting in issued NYSDEC drought warnings/watches have occurred, which impacted all counties: <ul style="list-style-type: none"> Severe Drought period – 1962 through 1966 August-September 1995 (aided in large wildfires consuming more than 6,000 acres of land) July - August 1999 January –May, September 2002 September 2003 July - August 2005 Drought was identified as a hazard in the NYS Plan. The NYS Plan indicated that L.I. experienced drought events in October 1994, November 2001-January 2002, and April – October 2002. The PC identified the drought hazard as impacting agriculture and exacerbating wildfire concerns, in certain parts of the county. 	<ul style="list-style-type: none"> NYSEMO CEMP NYS Plan Input from PC USGS NRCC -Coastal Climate Division NOAA
Earthquake	Yes	No	<ul style="list-style-type: none"> According to the NGDC, NYS has only had 9 reported earthquakes between 1800 and 2006. Only one of those earthquakes was within the vicinity of SC in 1871. No damages or reported deaths were reported for this incident. The NYS Plan did not identify earthquakes as “top hazard” in this area (Planning Area 1). USGS indicated that an 1884 Earthquake occurred within close proximity to Long Island and NYC (Amityville received significant damage), however, no other indication of earthquake hazard events was reported within the planning area. The PC did not identify earthquake as a significant hazard impacting the planning area. 	<ul style="list-style-type: none"> NOAA – Review of NGDC Earthquake Database from 1800 to present NYS Plan Input from PC USGS – Earthquake Hazards Program, Review of USGS Seismic Maps
Expansive Soils	Yes	No (affects Town of Smithtown)	<ul style="list-style-type: none"> USGS indicated that SC does not have the type of soils (swelling clay) that would result in expansive or swelling soils; therefore, SC has little to no swelling potential. Expansive soils are not identified as a hazard in the NYS Plan. The Town of Smithtown identified a localized problem with expansive soils, on or near a golf course. 	<ul style="list-style-type: none"> NYS Plan Input from PC Review of USGS 1989 Swelling Clays Map of the Conterminous

SECTION 5.2: RISK ASSESSMENT – IDENTIFICATION OF HAZARDS OF CONCERN

Hazard	Step 1	Step 2	Step 3	
	Is this a hazard that may occur in SC?	If yes, does this hazard pose a significant threat to the County?	Why was this determination made?	Source(s)
				United States.
Extreme Temperature	Yes	No	<ul style="list-style-type: none"> All counties of NYS have experienced extreme temperature events (heat waves or cold temperatures). Most recent events: <ul style="list-style-type: none"> July-August 2002 Heat Wave August 2006 Heat Wave (3,260 power outages throughout L.I.) Between 1998 and 2000, SC experienced cold temperatures that resulted in 4 hypothermia deaths. Extreme temperature was not identified as a hazard in the NYS Plan. The PC did not identify extreme temperatures as a significant hazard impacting the county. 	<ul style="list-style-type: none"> NYS Plan Input from PC
Flood (riverine, flash, coastal and urban flooding, and elevated groundwater)	Yes	Yes	<ul style="list-style-type: none"> SC is primarily bounded to the north, south and east by coastal waters NYS Plan indicated that SC has been issued 8 FEMA Disaster Declarations for flood events (mostly for Hurricane, Tropical Storm or Nor'easter events), each event resulting in millions of dollars in damages. 2 FEMA Declared Disasters specifically for flooding events unrelated to any other hazard, issued for SC, including: <ul style="list-style-type: none"> FEMA DR-129 (March 6-8, 1962) "Ash Wednesday Storm" FEMA DR-702 (April 1984) NYS Plan indicated that SC experienced 9 undeclared flooding events. SC was 2nd county in NYS (Nassau being the first) to be identified as a jurisdiction most threatened to flood and vulnerable to flood loss. According to NOAA's NCDC database, SC experienced 56 total flood events from 1950 to 2006 (this includes flash flood, urban flood and small stream flood). One event – October 2005 resulted in \$11 Million in damages. Flood was identified as a hazard in the NYS Plan. Elevated groundwater is considered a significant concern in the Lake Ronkonkoma area, Nissequoge River Basin, and the Village of Lake Grove. The PC considered flooding to be a significant hazard in the planning area. 	<ul style="list-style-type: none"> NOAA – NCDC Storm Events Query FEMA Declared Disasters for NYS NYSEMO NYS Plan Input from PC USACE
Groundwater Contamination (Natural)	Yes	Yes	<ul style="list-style-type: none"> The PC identified groundwater contamination, resulting from natural causes (e.g. nitrates and salt water intrusion), to be a concern in certain jurisdictions within the County, specifically Northport Area, North Fork, Shelter Island and Southold. Data from County Health Department. 	<ul style="list-style-type: none"> Input from PC SC Department of Health

SECTION 5.2: RISK ASSESSMENT – IDENTIFICATION OF HAZARDS OF CONCERN

Hazard	Step 1	Step 2	Step 3	
	Is this a hazard that may occur in SC?	If yes, does this hazard pose a significant threat to the County?	Why was this determination made?	Source(s)
Hailstorm	Yes	Yes	Please see Severe Storm	
Hurricane (tropical cyclones, including tropical storms and tropical depressions)	Yes	Yes	<ul style="list-style-type: none"> SC is primarily bounded to the north, south and east by coastal waters, therefore, highly susceptible to tropical cyclones, including hurricanes, tropical storms and tropical depressions. 7 FEMA Declared Disasters issued for SC, including: <ul style="list-style-type: none"> FEMA DR-26 (August 31, 1954) Hurricane Carol FEMA DR-45 (August 12-19, 1955) Hurricane Diane FEMA DR-311 (August 28, 1971 Tropical Storm Doria FEMA DR-520 (August 10, 1976) Hurricane Belle FEMA DR-750 (October 18, 1985) Hurricane Gloria Long Island FEMA DR-918 (September 16, 1991) Hurricane Bob FEMA DR-1296 (September 1999) Tropical Storm Floyd 16 hurricanes have greatly impacted SC from 1815 to 1999, including the Long Island Express (1938). Millions lost from hurricane damage along the coast of SC to beaches, property, roads/infrastructure, piers/docks, and businesses throughout history. Hurricane was identified as a hazard for SC in the NYS Plan. NYS Plan indicated that SC is located in Wind Zone 2 (Special Hurricane Zone) and SC experienced 3 historical major disaster declarations which resulted in millions in damages. The PC identified hurricanes and tropical storms as a significant hazard in the planning area. 	<ul style="list-style-type: none"> FEMA NYS Plan NOAA-NCDC SHELDUS Input from PC USACE
Ice Jams	No	No	<ul style="list-style-type: none"> No known historical occurrences, as per USACE CRREL Ice Jam Database. The NYS Plan does not have documented ice jam events for SC. The PC does not consider Ice Jams as a significant hazard affecting the County. 	<ul style="list-style-type: none"> NYS Plan Input from PC USACE CRREL Ice Jam Database
Ice Storm	Yes	Yes	Please see Severe Winter Storm	
Infestation	Yes	Yes	<ul style="list-style-type: none"> The NYS Plan did not recognize and “infestation” hazard in that plan. FEMA guidance documents (FEMA 386-2 and “Multi-Hazard Identification and Risk Assessment”) do not recognize the “infestation” hazard. The PC considers infestation to be a hazard impacting localized areas in the county. The Town of Babylon identified infestation by the Asian Long-horned Beetle to be a significant concern in their town. 	<ul style="list-style-type: none"> NYS Plan FEMA guidance documents Input from PC

SECTION 5.2: RISK ASSESSMENT – IDENTIFICATION OF HAZARDS OF CONCERN

Hazard	Step 1	Step 2	Step 3	
	Is this a hazard that may occur in SC?	If yes, does this hazard pose a significant threat to the County?	Why was this determination made?	Source(s)
Land Subsidence	No	No	<ul style="list-style-type: none"> NYS Plan indicates NYS is vulnerable to land subsidence; however, this hazard is “extremely localized” and poses a “very low risk to population and property.” NYS Plan does not identify SC as a community that has experienced land subsidence in the past. In general, moderate to low land subsidence susceptibility exists for NYS, however, it was identified that this hazard has a very low risk to population or property. According to USGS, SC is predominantly made up of unconsolidated aquifer systems, which excessive pumping of such aquifer systems could result in permanent subsidence and related ground failures. However, no such incidences have been reported within SC. The PC does not see land subsidence as a significant hazard affecting the County. 	<ul style="list-style-type: none"> NYS Plan Input from PC USGS Fact Sheet 165-00 (Dec. 2000)
Landslide	Yes	No	<ul style="list-style-type: none"> USGS indicates within the National Atlas Map Maker program that SC is identified as having high landslide susceptibility with a low incidence along the northern and eastern shoreline. A majority of SC is identified as a low landslide incidence. The NYS Plan identifies landslide as a hazard of concern. According to Figure 3-36, SC is divided with a low landslide incidence classification (southern SC) and high susceptibility to landslide/low incidence (northern SC). Table 3-53 indicated that SC has experienced 14 landslide events between 1837 and 1988. SC was listed as the No. 2 county in NYS most threatened by landslides and vulnerable to landslide loss. The PC does not consider landslide as a significant hazard affecting the County as a whole. Please note that the erosion of coastal bluffs, particularly in the north shore towns, is being considered under the Coastal Erosion hazard. 	<ul style="list-style-type: none"> NYS Plan Input from PC National Atlas.gov (USGS)
Nor'Easters (extra-tropical cyclones, including severe winter low-pressure systems)	Yes	Yes	<ul style="list-style-type: none"> SC is primarily bounded to the north, south and east by coastal waters, therefore, highly susceptible to Nor'Easters and other severe winter low-pressure systems. 1 FEMA Declared Disaster for a Nor'Easter issued for SC: <ul style="list-style-type: none"> FEMA DR-974 (December 12, 1992 Nor'Easter) Millions lost from Nor'Easter damage along the coast of SC to beaches, property, roads/infrastructure, piers/docks, and businesses throughout history. The PC identified Nor'Easters as a significant hazard in the planning area. 	<ul style="list-style-type: none"> FEMA NYS Plan NOAA-NCDC SHELDUS Input from PC
Severe Storm (windstorms, thunderstorms, hail, and	Yes	Yes	<ul style="list-style-type: none"> NOAA's NCDC storm events database indicates that SC was impacted by approximately 155 severe storm events between 1950 and 2006 causing a total of 20 injuries, 2 deaths and roughly \$2.0 million in property damage. SC HAZNY results indicate severe storms are a frequent event. 	<ul style="list-style-type: none"> NOAA – NCDC Storm Events Query Review of FEMA

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Hazard	Step 1	Step 2	Step 3	
	Is this a hazard that may occur in SC?	If yes, does this hazard pose a significant threat to the County?	Why was this determination made?	Source(s)
tornados)			<ul style="list-style-type: none"> NYS Plan indicates hurricanes and tornadoes are significant hazards that impact NYS. 13 tornadoes have impacted SC from 1958 to 2006, resulting in \$1 million to \$500 million in damages SC is No. 1 County in NYS most threatened by extreme wind and vulnerable to extreme wind losses. NYS Plan also indicated that 19 tornados have occurred in SC between 1950 and 2003. The PC identified severe storms as a significant hazard affecting the planning area. 	Declared Disasters for NYS <ul style="list-style-type: none"> NYSEMO NYS Plan Input from PC
Severe Winter Storm (heavy snow, blizzards, ice storms)	Yes	Yes	<ul style="list-style-type: none"> 3 FEMA Declared Disasters/Emergencies (EM) issued for SC, including: <ul style="list-style-type: none"> FEMA DR-1083 (December 1996) Southern NY Blizzard (Property damage = \$21.4 M) FEMA EM-3107 (March 1993) Statewide Blizzard FEMA EM-3184 (Feb. 17-18, 2003) Blizzard Various sources have indicated that SC has experienced over 30 winter storm events between 1970's and 2006. NYS Plan indicates winter storms (severe) are significant hazards that impact NYS. SC was listed as the No. 22 County in NYS most threatened by snow and vulnerable to snow loss. SC was listed for not having extreme snowfall potential, with an annual average snowfall of 23.8 inches. One major ice storm impacted the County in 1997, causing one death and 24 injuries. The PC does not see Ice Storms as a significant hazard affecting the County. The NYS Plan indicated that SC was listed as the No. 30 County in NYS most threatened by ice storms and vulnerable to ice storm loss. 	<ul style="list-style-type: none"> NYSEMO NWS FEMA NOAA-NCDC NY Journal News NYS Plan Input from PC
Shallow Groundwater Flooding	Yes	No	<ul style="list-style-type: none"> Shallow Groundwater Flooding was not identified as a hazard in the NYS Plan. Shallow groundwater conditions are found throughout the County, typically in low-lying areas (e.g. coast, near surface water bodies (including wetlands, marshes and bogs), and along ancestral drainage courses) Persistent structural flooding losses have occurred in SC as a result of shallow ground water, underscored by serious ongoing problems in the areas particularly around Lake Ronkonkoma and the Northeast Branch of the Nissequogue River in the Town of Smithtown. Approximately 3,002 parcels (most residentially developed) are impacted by shallow groundwater within the affected area of Smithtown. Based on all available information, shallow groundwater flooding problem areas also 	<ul style="list-style-type: none"> NYS Plan USGS, WRIR 01-4165, 2002 USGS SIR 2004-5152 NYS DEC H2M Corporation (1980) SC Planning Department

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Hazard	Step 1	Step 2	Step 3	
	Is this a hazard that may occur in SC?	If yes, does this hazard pose a significant threat to the County?	Why was this determination made?	Source(s)
			<p>identified to date include areas in Islip, Brookhaven, Huntington, Babylon, and Shelter Island.</p> <ul style="list-style-type: none"> ○ The Town of Babylon reports that shallow groundwater has been a problem in Babylon since initial development over a hundred years ago. ○ Approximately 73 residential or undeveloped parcels are impacted by shallow groundwater within the affected area of Shelter Island. ○ Two properties specifically impacted by shallow groundwater flooding conditions are identified in the Town of Huntington. <ul style="list-style-type: none"> ● NYS DEC Regional Director Peter Scully indicated the groundwater table is the highest it has been in 34 years throughout Long Island, surging after heavy rains in October, 2005. In 2006, the water table around Lake Ronkonkoma remains near record levels. 	<ul style="list-style-type: none"> ● SC Department of Health Services
Tornado	Yes	Yes	Please see Severe Storm	
Tsunami	No	No	<ul style="list-style-type: none"> ● Tsunami is not identified as a hazard of concern in the NYS Plan. ● The PC does not consider tsunami to be a significant concern to the planning area. 	<ul style="list-style-type: none"> ● NYS Plan ● Input from PC
Volcano	No	No	<ul style="list-style-type: none"> ● There are no volcanoes located in NYS. 	<ul style="list-style-type: none"> ● NYS Plan ● Input from PC
Wildfire	Yes	Yes	<ul style="list-style-type: none"> ● Severe wildfires have taken place within SC, resulting in millions in damages and significant loss to over 6,000 acres of land, particularly the “Sunrise Fires” of 1995 (FEMA FSA-2115). ● SC is more susceptible to wildfires due to the presence of certain environmental conditions that sustain wildfire conditions (e.g. Pine Barrens, state parks) which provide fuel needed for wildfires. The Pitch Pine, oak, and ericaceous shrub-dominated forests of the Central Pine Barrens represent an extremely volatile fuel type with a long history of severe fires, therefore, presenting a significant wildland-urban interface hazard. ● NYS identified the Central Pine Barrens as one of its highest wildfire hazard area (The Central Pine Barrens consists of 100,000 acres covering portions of the Towns of Brookhaven, Riverhead and Southampton in SC. An estimated 59,500 people live in 23,180 housing units within this area.) ● NYS Plan indicates that the L.I. Pine Barrens are the second largest in size within the Country, with roughly 52,000 acres of open space and consists of fire-dependent vegetative species, therefore, prone to larger wild land fires. The NYS Plan indicated that SC experienced two wildfires in 1995 and 2001. 	<ul style="list-style-type: none"> ● NYS Plan ● Input from PC ● FEMA ● NWPD

Hazard	Step 1	Step 2	Step 3	
	Is this a hazard that may occur in SC?	If yes, does this hazard pose a significant threat to the County?	Why was this determination made?	Source(s)
			<ul style="list-style-type: none"> The PC considered wildfire to be a significant concern in certain parts of the County. 	
Windstorm	Yes	Yes	Please see Severe Storm	

CEMP	Comprehensive Emergency Management Plan
CRREL	Cold Regions Research and Engineering Laboratory
DR	Presidential Disaster Declaration Number
EM	Presidential Disaster Emergency Number
FEMA	Federal Emergency Management Agency
HAZNY	Hazards New York
L.I.	Long Island
NCDC	National Climatic Data Center
NGDC	National Geophysical Data Center
NID	National Inventory of Dams
NOAA	National Oceanic and Atmospheric Administration
NPDP	National Performance of Dams Program
NRCC	Northeast Regional Climate Center
NWS	National Weather Service
NWPD	National Wildfire Programs Database
NYS	New York State
NYSDEC	New York State Department of Environmental Conservation
NYSEMO	New York State Emergency Management Office
PC	Planning Committee
Plan	Hazard Mitigation Plan
USACE	U.S. Army Corp of Engineers
USEPA	U.S. Environmental Protection Agency
USGS	United States Geologic Survey
SC	Suffolk County
SIR	Scientific Investigations Report
WRIR	Water-Resources Investigations Report

In summary, a total of eleven (11) natural hazards of concern were identified as significant hazards affecting the entire planning area, to be addressed at the county level in this plan (shown here in alphabetical order):

- Coastal Erosion
- Drought
- Flooding (riverine, flash, coastal, and urban flooding)
- Groundwater Contamination (natural)
- Hurricane (tropical cyclones, including tropical storms and tropical depressions)
- Infestation (Asian Longhorn Beetle, Lyme Disease and West Nile Virus)
- Nor'Easters (extra-tropical cyclones, including severe winter low-pressure systems)
- Severe Storms (windstorms, thunderstorms, hail, lightning and tornados)
- Severe Winter Storm (heavy snow, blizzards, ice storms)
- Shallow Groundwater
- Wildfire

While not posing significant risk to the county as a whole, the following natural hazards pose significant concern in local areas within the county, and are addressed within the annexes of jurisdictions affected:

- Expansive Soils – Town of Smithtown

Other natural hazards of concern that have occurred within SC, but have a low potential to occur and/or result in significant impacts within the County, and will not be further addressed within this version of the Plan include earthquakes and extreme temperatures. These hazards may be considered in future versions of the Plan.

5.3 HAZARD RANKING

The hazards of concern are ranked for SC as a whole to describe their probability of occurrence and their impact on population, property (general building stock including critical facilities) and the economy. Each participating Town or Village may have differing degrees of risk exposure and vulnerability compared to the County as a whole; therefore each Town/Village ranked the degree of risk to each hazard as it pertains to their community using the same methodology as applied to the County-wide ranking. This assures consistency in the overall ranking of risk process. The hazard ranking for each participating Town or Village can be found in their jurisdictional annex in Volume II of this Plan.

HAZARD RANKING METHODOLOGY

This section describes factors that influence the ranking including the probability of occurrence and impact; it also presents the ranking process and outcome. Estimates of risk for Suffolk County were developed using methodologies promoted by FEMA's hazard mitigation planning guidance and generated by FEMA's HAZUS-MH risk assessment tool.

Probability of Occurrence

The probability of occurrence is an estimate of how often or frequent a hazard event occurs. A review of historic events assists with this determination. Each hazard of concern is rated in accordance with the numerical ratings and definitions in Table 5-2. These definitions are consistent with FEMA's Multi-Hazard Identification and Risk Assessment report (FEMA, 1997).

Table 5-2. Probability of Occurrence Ranking Factors

Rating	Frequency	Definition
0	None	Hazard event that occurs less frequently than once in 1,000 years ($>10^{-3}/\text{yr}$) / Hazard event is not likely to occur
1	Rare	Hazard event that occurs from once in 100 years to once in 1,000 years ($10^{-2}/\text{yr}$ to $10^{-3}/\text{yr}$)
2	Occasional	Hazard event that occurs from once in 10 years to once in 100 years ($10^{-1}/\text{yr}$ to $10^{-2}/\text{yr}$)
3	Frequent	Hazard event that occurs more frequently than once in 10 years ($>10^{-1}/\text{yr}$)

Impact

The impact of each hazard is considered in three categories: impact on population, impact on property (general building stock including critical facilities), and impact on the economy. Based on documented historic losses and a subjective assessment by the Planning Committee, an impact rating of high, medium, or low is assigned with a corresponding numeric value for each hazard of concern. In addition, a weighting factor is assigned to each impact category: three (3) for population, two (2) for property, and one (1) for economy. This gives the impact on population the greatest weight in evaluating the impact of a hazard.

Table 5-3 presents the numerical rating, weighted factor and description for each impact category: people, property and the economy. Please refer to Appendix F for a more detailed description of how the values were assigned.

Table 5-3. Numerical Values and Definitions for Impacts on Population, Property and Economy

Category	Weighting Factor	Low Impact (1)	Medium Impact (2)	High Impact (3)
Population*	3	14% or less of your developed land area is exposed to a hazard due to its extent and location	15% to 29% of your developed land area is exposed to a hazard due to its extent and location	30% or more of your developed land area is exposed to a hazard due to its extent and location
Property*	2	Property exposure is 14% or less of the total replacement cost for your community	Property exposure is 15% to 29% of the total replacement for your community	Property exposure is 30% or more of the total replacement cost for your community
Economy	1	Loss estimate is 9% or less of the total replacement cost for your community	Loss estimate is 10% to 19% of the total replacement cost for your community	Loss estimate is 20% or more of the total replacement cost for your community

Notes:

A numerical value of zero is assigned if there is no impact.

*For the purposes of this exercise, “impacted” means exposed for population and property and loss for economy.

Risk Ranking Value

The risk ranking for each hazard is then calculated by multiplying the numerical value for probability of occurrence by the sum of the numerical values for impact. The equation is as follows: Impact Value (1, 2, or 3) X Impact Value (6 to 18) = Hazard Ranking Value. Based on the total for each hazard, a priority ranking is assigned to each hazard of concern (high, medium, or low).

HAZARD RANKING RESULTS

Using the process described above, the risk ranking for the identified hazards of concern was determined for the County. Based on the combined risk values for probability of occurrence and impact to the County, a priority ranking of “high”, “medium” or “low” risk was assigned. The hazard ranking for the County, from high to low risk, is summarized below:

The following tables present the step-wise process for the ranking. Table 5-4 shows the probability ranking assigned for likelihood of occurrence for each hazard.

Table 5-4. Probability of Occurrence Ranking for Hazards of Concern for Suffolk County

Hazard of Concern	Probability	Numeric Value
Coastal Erosion	Frequent	3
Drought	Frequent	3
Flooding (riverine, flash, coastal and urban flooding)	Frequent	3
Groundwater Contamination (natural)	Frequent	3
Hurricane (tropical cyclones, including tropical storms and tropical depressions)	Occasional	2
Infestation (ALB, Lyme, WNV)	Frequent	3
Nor'Easters (extra-tropical cyclones, including severe winter low-pressure systems)	Frequent	3
Severe Storms (windstorms, thunderstorms, hail, lightning and tornados)	Frequent	3
Severe Winter Storm (heavy snow, blizzards, ice storms)	Frequent	3
Shallow Groundwater	Frequent	3
Wildfire	Occasional	2

Table 5-5 shows the impact evaluation results for each hazard of concern, including impact on property, structures, and the economy. The weighting factor results and a total impact for each hazard also are summarized.

Table 5-5. Impact Ranking for Hazards of Concern for Suffolk County

Hazard of Concern	Population			Property			Economy			Total Impact Rating (Population + Property + Economy)
	Impact	Numeric Value	Multiplied by Weighting Factor (3)	Impact	Numeric Value	Multiplied by Weighting Factor (2)	Impact	Numeric Value	Multiplied by Weighting Factor (1)	
Coastal Erosion	Low	1	3	Low	1	2	High	3	3	8
Drought	None	0	0	None	0	0	High	3	3	3
Flooding (riverine, flash, coastal and urban flooding)	Low	1	3	Low	1	2	Low	1	1	6
Groundwater Contamination (natural)	Medium	2	6	None	0	0	Low	1	1	7
Hurricane (tropical cyclones, including tropical storms and tropical depressions)	High	3	9	High	3	6	High	3	3	18
Infestation (ALB, Lyme, WNV)	Medium	2	6	None	0	0	Low	1	1	7
Nor'Easters (extra-tropical cyclones, including severe winter low-pressure systems)	High	3	9	High	3	6	High	3	3	18
Severe Storms (windstorms, thunderstorms, hail, lightning and tornados)	High	3	9	High	3	6	Low	1	1	16
Severe Winter Storm (heavy snow, blizzards, ice storms)	High	3	9	High	3	6	High	3	3	18
Shallow Groundwater	Low	1	3	Low	1	2	Medium	2	2	7
Wildfire	Low	1	3	Low	1	2	Low	1	1	6

Table 5-6 presents the total ranking value for each hazard.

Table 5-6. Total Risk Ranking Value for Hazards of Concern for Suffolk County

Hazard of Concern	Probability	Impact	Total = (Probability x Impact)
Coastal Erosion	3	8	24
Drought	3	3	9
Flooding (riverine, flash, coastal and urban flooding)	3	6	18
Groundwater Contamination (natural)	3	7	21
Hurricane (tropical cyclones, including tropical storms and tropical depressions)	2	18	36
Infestation (ALB, Lyme, WNV)	3	7	21
Nor'Easters (extra-tropical cyclones, including severe winter low-pressure systems)	3	18	54
Severe Storms (windstorms, thunderstorms, hail, lightning and tornados)	3	16	48
Severe Winter Storm (heavy snow, blizzards, ice storms)	3	18	54
Shallow Groundwater	3	7	21
Wildfire	2	6	12

As shown Table 5-6, Nor'Easters and Severe Winter Storms have equivalent total risk ranking values (54), as do Groundwater Contamination (natural), Infestation and Shallow Groundwater (21). Table 5-7 presents the hazard ranking category assigned for each hazard of concern. For hazards of concern with equivalent total risk ranking values, they appear in alphabetical order.

Table 5-7. Hazard Ranking Results for Hazards of Concern for Suffolk County

Hazard Ranking	Hazard of Concern	Category
#1	Nor'Easters (extra-tropical cyclones, including severe winter low-pressure systems)	High
	Severe Winter Storm (heavy snow, blizzards, ice storms)	High
#2	Severe Storms (windstorms, thunderstorms, hail, lightning and tornados)	High
#3	Hurricane (tropical cyclones, including tropical storms and tropical depressions)	High
#4	Coastal Erosion	Medium

Hazard Ranking	Hazard of Concern	Category
#5	Groundwater Contamination (natural)	Medium
	Infestation (ALB, Lyme, WNV)	Medium
	Shallow Groundwater	Medium
#6	Flooding (riverine, flash, coastal and urban flooding)	Medium
#7	Wildfire	Low
#8	Drought	Low